SUPPLEMENT.

The Mining Journal,

RAILWAY AND COMMERCIAL GAZETTE:

FORMING A COMPLETE RECORD OF THE PROCEEDINGS OF ALL PUBLIC COMPANIES.

No. 1109.—Vol. XXVI.] LONDON, SATURDAY, NOVEMBER 22, 1856. [GRATIS.

Original Correspondence.

THE MINES AND MINERALS OF AMERICA.—No. VII.

VIRGINIA: CARROL COUNTY.

Virginia, the old dominion, the sink of the Englishman's purse; the richest state, with the poorest name in the Union,—how long is she destined to bear this stain upon her escutcheon? Who is there to stand up in her defence, and rescue this land of wealth from the odium that surrounds it? The reply must be, No one. Yes, indeed, it must be so: an individual cannot achieve such a task. But, nevertheless, it is possible to greatly alleviate, if not radically cure, the evil. It can be done by a combination of practical men; and those who have given the mineral department of its resources their close attention will admit—and all do admit—the land has been belied in every way, both for and against her interests. Teeming with riches up to the very surface, her mines became a prey for the greedy speculator: they became a medium through which the greatest frauds and deceptions have been practised. And the result is to be too easily seen throughout the length and breadth of the land. Such things at this day ought not to exist. It might be said by many that the evil is rapidly wearing itself out; perhaps it is, but in its convalescence, the apathy it has engendered among the people renders the cure nearly as bad as the disease. The people have so long been accustomed to look for aid from the foreigner, that all their natural energy has become dissipated. The traveller, on visiting a good mineral property, naturally asks, Why are the mines not wrought? The reply is, invariably, We want a good English company. But how these good English companies have been treated is a matter on which hangs a tale, not always told to the stranger.

Our English capitalists, who have been submitted to losses in this section of the country, are very prone to heap all the blame on this side; but if they were dispassionately and carefully to investigate a few cases, they would come to the conclusion that their own agents were far more culpable than the Virginians. It is not my province to reiterate the grievances of the past. That English capital has been lavishly expended and lost is patent to the mining world. To point out a remedy, or to lay out a safe track for the present and future adventurer, will be far more commendable. I, therefore, propose, in the several articles I shall send you from time to time on Virginia, to describe the properties as they really are, not to exalt them above their true merits, or depreciate them below par value.

There has been for some time past a good deal said about the immense lode and the riches of the Tennessee and Carrol Copper Mines. Being on a tour between the Blue Ridge and Alleghany Mountains, I travelled over from Montgomery into Carrol to examine those mines; and although I cannot confirm all that has been said about them, yet I was very much pleased with what I saw.

The Carrol Mines are in the district of Cranberry Plains, Carrol county, and are situate on the south-western slopes of the Blue Ridge, or perhaps, more generally speaking, the western slope of the eastern range of the Alleghany Mountains, and about 25 miles from the Virginia and Tennessee Railway. The strata in which they are found are principally mica-slate, but purple, blue, green, and red talcose, and clay-slates, occur in narrow bands in their vicinity. There are about 12 or 14 mines, or rather mine openings: the deepest shaft does not exceed 7 fms. The chief of these are called the Ann Phips, Cranberry, Betty Bak r, Dalton, Wild Cat, Fairmound, Leegrand, Kirkbridge, and Sally Ellen. Several of them are worked under an association, of which Mr. Baughman and Mr. O'Neil are the managers. A description of two will suffice for the whole. The Ann Phips is in a channel of highly mineralised ground, of about 100 ft. thick; in it is a champion lode, about 8 ft. thick, reposing on a footwall of mica-slate; it underlies rather flat, being, as far as I could see, about 55° towards the south-east. Its general range is 50° north-east, seen by surface out-croppings, but I am inclined to think it will be found to be only about 35° north-east when cut in depth. The country of the hanging-wall is composed of garnet slate—that is to say, clay and mica-slate, very thickly interspersed with red garnets. Its matrix consists of vein quartz, arsenical pyrites, copper, gossan, and decomposed slate, with a strong flookan on the footwall. It throws up to the surface a mass of the most beautiful bright gossan, richly impregnated with grey and black copper ore, in thin veins; these branch out both vertically and laterally, and encompass a space of nearly 100 ft. wide, while the enclosed ground is highly mineralised. The spreading out of these offshoots has given rise to a very common error—that the lode itself is 100 ft. wide, while in reality it will not be found much to exceed 8 ft. Nor is it upon these veins, droppers, and branches that all the mining operations have been carried on, The mode of working is to sink a small shaft down through the mass of gossan, and when a vein has been cut rich enough it is driven on, and stoped away up so far as it holds productive. At about 35 feet from surface these branches concentrate, and the lode becomes a nearly solid mass of white mundic, spotted throughout with yellow and grey ore. This forms a barrier to further sinking, it being so excessively hard. The ores taken from this small vein and flookans consists of decomposed grey and black sulphurets: they are called "smut ores," from their dark appearance. It is commonly said the main produce of the mines is the black oxide of copper, but this is incorrect, although there is found in many samples a good quantity of fibrous and small-grained crystallised metallic copper, some of the specimens I examined are very beautiful: the flookans are very rich in green and blue carbonates, with fine prills of yellow and grey ore. There is no dressing apparatus or machinery of any kind on the mines: the ore is selected by hand, and assays made on the spot. A pile that will give a produce of about 26 per cent., which is about the average, is then placed in boxes, and sent to the smelting works at Baltimore, Newhaven, or Boston, where it realises a good price, while the remainder is thrown away. I should say that at this time there are thousands of tons of ore and ore stuff at grass that will yield from 10 to 15 per cent., but the long and expensive carriage at present renders it useless to the proprietors; this, however, will be remedied in time, there being now a project in course for erecting a smelting works at Cranberry Plains. The country abounds in fine hard-wood timber, therefore charcoal for smelting may be obtained cheaply, and as there are abundance of low grade ores, there is every reason to anticipate the works will amply repay the cost of erection and working.

The Dalton Mine lies about three-fourths of a mile south-east of the Ann Phips. It consists of a shaft sunk in a ravine, about 20 ft. into the lode, and pourtrays its general character better than any other at this depth; it is 12 ft. into the solid mundic, and looks very promising, having a vein of quartz on both walls. I should think it is not less than 12 ft. thick. It throws up a surface gossan, the same as the others, but being in a valley, the mundic is reached at a more shallow depth: it is very hard for sinking on its course, but very easy in the country; it should, therefore, be sunk on under the footwall, or dzew, of the lode. The specimens I brought away contain about 8 per cent. of yellow copper, and a great quantity might be selected as good stamps work.

Now several of these mines are worked down as low as the proprietors can go without the aid of machinery and proper engine-shafts; they will, therefore, be brought on the market for sale. The specimens produced will be of the most glittering description, while the account of the returns, produce, and expenditure will figure beautifully on paper; but I would advise any English house embarking in them to carefully estimate the working cost before they issue a prospectus. Large returns of copper ore, of good produce, can be made for some time, with the aid of very simple machinery, but for the permanent workings deep sinking is necessary. The lode is a masterly one, and is of a very promising character; it must make great quantities of ore in depth; this ore will be yellow sulphuret, and may yield from 12 to 20 per cent., which I consider, with economical management, will amply repay the adventurers. Labour is comparatively cheap, while fuel for the engines is everywhere abundant, and may be obtained in many places for the cost of cutting.

Persons visiting this district should start from Christiansburg, Montgomery county, on horseback, which is the only mode of easy conveyance to see the country. The distance is 45 miles, a rather hard day's ride for the amateur, but scarcely felt, on account of the many interesting scenes met with on the road. The horses are good ones for the rough and rocky roads: they will go an ambling pace of five to six miles per hour. The most interesting route I would advise to see the geology of the country, would be from Christiansburg to a place called Mountain Tan Yard, where bait for the horses and refreshment may be obtained. This is in Pulaski county: here you pass through a gap in the mountain, and descend a dark pine-wooded ravine, called the Shades of Death, to the shores of the New River, or upper waters of the Great Kanawha; it is a wide but shallow stream, and after traversing its banks for three miles it is fordable about three-fourths of a mile above Chaffy's Ferry. The country here changes to limestone. Ascending the high ground, some bold cliffs are encountered. After crossing Bigreed Island river, you traverse a deep rocky ravine, making frequent fordings of the stream. There are several caverns in the cliffs, and many interesting changes in the formation may be seen. This valley is several miles long. At length you wind round the cliffs, and get into a new road, and, near a log cabin, strike into the forest. A bridle path leads to the mines of Cranberry Plains, where, at the plantation of Mr. Early, one of the mine proprietors, good accommodation for man and horse, and a hearty welcome, in true Virginian style, will be tendered. In returning, it is best to pass through Hillsville, the county Court-house town; and thence over Indian Creek, through Floyd county. In this route many very strong lodes will be passed over; one of them has been partially opened on; it looks promising, being composed of mundic, prian, spar, decomposed killas, and spotted with copper ore. Its bearing is 25° north-east, and the country easy for sinking.

Such is a brief outline of the Carrol Mines. I could particularise more fully, if it ever should be required, but for the purpose in view the above may be sufficient. My next article will treat on the anthracite coal district of Montgomery county, where mining is about being commenced.

Southampton, Massachusetts. —— C. S. Richardson.

ANTHRACITE COAL FOR LOCOMOTIVES.

Sir,—British railways are not only the greatest wonder of the age, but the greatest delusion also; a capital of 286,000,000*l.* has been expended in their construction; still, with this amazing expenditure, the gross annual receipts amount to 20,215,724*l.* (or equal to a trifle over 7 per cent. on railway investments), while the yearly dividends average less than 3½ per cent. Whence this great difference? There must be something seriously wrong, when more than half the receipts are swallowed up in the working and management of railroads. That great authority on railway matters, Mr. Stephenson, has stated, that if only one farthing can be saved in the train-mileage of the United Kingdom, no less a sum than 80,000*l.* can annually be gained for shareholders; therefore, after such a statement as this, if railway proprietors desire better dividends than they now have, it entirely rests with themselves.

It is becoming more clearly evident, that *saving* in the working and management of railroads is the only chance now left to improve dividends; some more sanguine may look to increased traffic; but this, to a great extent, under the present system of working and management, is fallacious, for working expenses will augment in an almost equal ratio with extended railway trade. Others may, again, hope for some panacea from Parliament; but this is equally delusive—nay, even *fatuous;* for, can it ever be forgotten, that past legislative interference, coupled with landlord influence, which may be almost considered as synonymous, has chiefly caused the present disastrous state of railway property?

Reflection almost stands appalled at the thought that England, the land of railway invention, and also of cheap labour, cheap iron, and cheap coal—that all these advantages should have been so counterbalanced by law and fraud, as to cause English railways to be the least remunerative of any in the world!

With this introduction, permit me to show, and that as briefly as possible, by facts and figures, not only the *practicability*, but also the *economy*, in using anthracite coal in locomotive engines. I shall here have to refer to those valuable railway statistics of Mr. Stephenson to explain more fully my views to uninitiated shareholders. This gentleman has stated "it requires 2,000,000 tons of coal annually for locomotive fuel—that there are 5000 locomotive engines in constant use, which perform in the aggregate a distance of 80,000,000 train miles yearly." Now, taking these figures merely as a basis for calculation, it would appear that each engine ran yearly 16,000 miles, and consumed for this distance 400 tons of coal, or equal to about 56 lbs. of coal for every mile. Of course, every one is aware that it is not coal in its unprepared state that is used, but coal that is baked, or, in other words, "coke;" but, at the same time, very few may probably be acquainted with the great expense, waste, and loss of time incurred in converting coal into coke for railway purposes, therefore a few words in explanation may not be inappropriate. Firstly, there is the cost of the coal, which varies in price according to its quality, and the nearness of the coal mines to the various railways. From these causes it is difficult to fix a correct value, but I think if it is rated at 16s. per ton upon *delivery* at any railway coke oven in the kingdom, it would be a fair *average* cost. Secondly, there is the conversion of this coal into coke, which requires 95 hours—a space of time nearly equal to four days and nights. During this long period a *double waste* is going on; firstly, in the coal that is being baked or prepared; and, secondly, in the fuel that is required to bake it. Then there is the cost of superintendence all this time, besides the excessive wear and tear of the furnaces, ovens, &c.; therefore, taking these three items into account—viz., waste, labour, and wear and tear—I think it would not be unreasonable to estimate the waste at one-fourth of the cost of the coal, and the labour and the wear and tear as equal to the *whole* of the first cost of the coal. These three charges would thus make 20s., and which amount added to the first cost of the coal would show railway coke to cost 36s. per ton. Recollect, I do not give this price (viz., 36s.) as *exact*, but merely as an average, and as some data to proceed with, for the cost of railway coke differs on almost every railroad. At the same time, every railway engineer *can*, and every railway engineer *should*, and, what is of more importance still, every railway shareholder *ought* to know not only what it costs per ton for railway coke, *but what such fuel costs for transporting a ton of goods per mile.* I believe it is scarcely yet known what is the *minimum* weight of fuel that will propel a given weight a given distance. Such a problem can only be solved by a series of nice experiments, and which many may look upon as useless knowledge for *practical* purposes; for it may be said, if exactly known, an engineer could not at all times—nay, very seldom—proportion the power to the weight, as a train must run at a stated period, whether full or half full; but such reasoning is inadmissible, if there is any truth in the maxim that "knowledge is power," for if the right kind of fuel, and its exact proportions of weight and power, were clearly known, such knowledge could be taken advantage of at every practicable opportunity.

As I am prevented, from the scantiness of English railway data, to show that we are using, not only the wrong kind of fuel, but the most expensive article, and that, too, in an extravagant manner, I shall be obliged, in order to support such assertions, to draw indirect proofs from American railway reports; for from these I can learn what it costs for fuel for transporting a ton of goods per mile. For example, a train of cars, containing 368 tons of coal, was transported a distance of 190 miles, at a cost for fuel of $52·35, or equal to 7-48 mills per ton per mile; which amount, converted into English money, would be about 1-32d of a penny per ton per mile. What it costs per ton per mile on English railways I have no means of ascertaining correctly; but in order to show more clearly my meaning, I will endeavour to make some approximation of costs; then, keeping to Mr. Stephenson's statistics, it would require 56 lbs. of coal, or 42 lbs. of coke, to propel an engine and train one mile; and if this coke is estimated to cost 36s. per ton, it would be equal to 8d. per mile for fuel for a locomotive and train; then, to arrive at what this would be per ton per mile, an average freight or weight of train must be taken,—say, for instance, 100 tons for each train, which would make the cost about 3-32d of a penny per ton per mile for railway coke. I am well aware that such a mode of calculation is objectionable; for, if 300 tons were taken as an average weight of train, instead of 100 tons, it would reduce the cost of fuel to 1-32d of a penny per ton per mile, or the same price as on this America line just quoted. It is, however, probable that neither of these weights are fair averages, and the difficulty to find a correct one, arises from the great difference in the nature of railway traffic in the two countries,—for instance, in America, the great bulk of railway transportation consists of *merchandise;* whereas, in England, it is the reverse, being mostly *passengers.*

Now, this fact alone shows there must be a great leakage somewhere in railway matters with us; for passenger traffic is much less costly as regards working expenses than goods traffic, for the wear and tear to railroads by the latter is excessive. Besides, what country in the world equals England in the combined advantages for making railroads profitable—viz., that of a concentrated, numerous, enterprising, and commercial population? Where else can be found such elements, capable of not only bringing down working railway costs to the lowest minimum, but of obtaining at the same time maximum railway receipts? However, as this approximation of cost for fuel per ton per mile is open to some objections, from the difficulty of forming a correct estimate of the average weight of trains in England and America, I will proceed to institute a comparison of the cost of fuel per train mileage in these two countries.

I have already estimated that on English lines the cost of railway fuel is 8d. per train mileage—that is to say, whether a train carries 100 or 300 tons of goods, or 500 or 1000 passengers, the cost per *mile* for fuel in the present calculation is to remain the same. Now, what is the cost per train mileage on the American railroad just referred to, which conveyed 368 tons of coal 190 miles, at a charge for fuel of $52·35? It is 27 c., or in English money equal to about 1s. 1d. per mile trainage, or 5d. per mile *more* than the estimated cost on British lines; this excess, therefore, requires some explanation, for it would seem that 368 tons was carried at a *cheap* rate for fuel when calculated at *per ton per mile*, and the *reverse* when taken at *per train mileage.* Then, to account for this seeming discrepancy, the following particulars should be taken into consideration:—368 tons is a heavy freight for *one* engine, and it would require an "Atlas," or one of the first-class locomotive engines, to draw such a weight (for this, of course, is *exclusive* of the weight of trucks, engine, and tender, which probably weighed *half* the freight), and upon referring I find that the weight of the *locomotive alone* that drew this load was 27 tons, and that it consumed fuel in proportion to its Titanic size, devouring no less than 11·87 cords of pine wood, which is equal to about 6 tons of coal; therefore, taking into account the *kind* and *quantity* of fuel used in this instance, for pine wood is about the dearest food for the "iron horse," I think it will be allowed that 1s. 1d. is too high an average for American trains, even should it not be admitted that 8d. is too low a one for English lines; and it will probably be found, upon further investigation, that a *true average* is somewhere *between* these limits. But I will not now proceed further in such an enquiry, as I am prepared to adopt these rates, of 8d. and 1s. 1d., for my present calculations, as I find I shall then have, with such apparent disadvantages, sufficient evidence to make good my statements. As fuel is so large an element in the cost of railway working, a great deal of time has latterly been bestowed on this subject, and many plans have been suggested to reduce this heavy outlay, more particularly so in America, where wood is every year getting dearer; fortunately, then, for railway shareholders in that country, a substitute has been found for wood, and that, too, without having recourse to a manufactured article in the shape of coke, for they, as well as ourselves, possess a similar commodity ready made, being no less than anthracite coal, or Nature's coke, but which at present our transatlantic cousins only have had the good sense not merely to appreciate, but the ingenuity successfully to employ. In consequence of this discovery and application of *Nature's railway fuel*, a complete revolution has and is taking place in America in the use and cost of this most important material in railway working, for it has there been clearly and practically demonstrated that the use of anthracite coal has reduced the cost of railway fuel more than one-half; so that, supposing the charge for the train mileage before to have been 1s. 1d., it would now be about 6d., or 2d. per train mileage less than the English lines—that is, presuming 8d. per mile to be a *fair* average estimate. Now, after all these nice calculations, some may exclaim, *Cui bono?* To satisfy such, I beg to remind them of the statement of Mr. Stephenson, "that a saving of *one farthing* in the *train mileage* is a gain to shareholders of 80,000*l.* annually;" therefore, 2d., or eight farthings, is equal to 640,000*l.* an amount which would increase the dividends

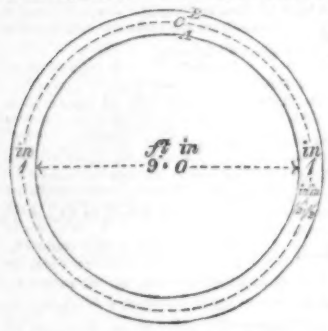
on the *whole* of railway investments nearly ½ per cent." Now, one word as to the advantages and practicability of our copying the Americans in this respect; for, independently of price, anthracite coal has many advantages over coke; it can be easily weighed, thus readily checked; there is no loss of time, no waste, no mystery about it; and it can also be kept in store without deterioration, besides being in every way a more compact and cleaner article than coke, for it is equally smokeless, without its dirt, dust, or impurities. Then, as regards cost, it is, or ought to be, one-third less in price than railway coke. A fair trial of this combustible should be made, and to which there ought not to be the least objection, or any possible excuse or difficulty, since the Great Western Railway now spreads its lines to and through the anthracite coal district of South Wales; therefore, to that company seems to belong the honour of bringing this coal into use, from its position being the most suitable one to test the practicability and economy of anthracite coal for locomotive engines, as it can procure this article at the lowest possible cost. The fire-grates, &c., of the engines now in use would, of course, have to be a little altered to burn this coal, but this could be effected at a little trouble and expense, by procuring the necessary information and license from the American patentee. I have no fear, with impartial experiments, what the result will be, for there is not a shadow of reason, or a cloud of difficulty, against the successful employment of this coal, as it is now in daily use in American locomotive engines.

Nov. 12. A RAILWAY SHAREHOLDER.

PRACTICAL MINING—COLLIERY OPERATIONS.

SIR,—I beg to draw the attention of some of your readers to what seems to me to be an error, in a work much used by colliery engineers in the North—so much used as to have become almost a text-book—Hann and Dodd's *Mechanics for Practical Men*, ed. 1833, p. 147, *et seq.*

In the mode of calculating the depth of a pit, with diameter of rope-roll, number of strokes, and thickness of rope given, the length of the first turn is taken to be that of the circumference of the rope-roll, and of the last turn to be that of the circumference of the roll, plus the rope *up to* the last turn; but the length of the first turn is not that of the circumference of the rope-roll, but of the rope-roll plus *once the thickness* of the rope; for the under side, A, is compressed, and the upper side, B, elongated equally, the centre, C, being the true length—that is (9 ft. + 1 in.) × 3·1416 = 28·5352 ft., instead of 9 ft. × 3·1416 = 28·2744 ft.; and the same of the last turn, which ought to be (9 + 2½ ft. + 1 in.) × 3·1416 = 36·3892 ft., instead of (9 ft. + 2½ ft.) × 3·1416 = 36·1824, ultimately working out to a depth of 86·5659 fms. instead of 85·8704 fms. And it will be found by working the question back by previous rule, p. 148, to find the diameter of rope-roll, depth being given, that this latter depth of 85·8704 fms., as given by Hann and Dodd, will not give a rope-roll of 9 ft. diameter, but of 8 ft. 11 in.—the former depth of 86·5659 fms., however, working out correctly.



In this particular case the error ·6955 fm. is not of much magnitude, the rope being small, and the depth not great; but in a deep pit, with 20-ft. rope-roll, 2½-in. rope, and drawing in 20 strokes, the error will be found to be considerable—viz., a corrected depth of 253 fathoms against 250·9 fms., as calculated by Hann and Dodd's rule. DELTA.

Oct. 27.

OUR GLOBE, AND THE GEOLOGISTS.

SIR,—As one of the early and rational school of geologists, founded early in this century by the lamented Mr. Greenough, Dr. Wm. Smith, my late father, and other solid and observing men, I was excessively pleased to read the letter from Mr. Evan Hopkins, in your last Journal. The very name of the science did not exist until it was created by the early members of the Geological Society, patient thinkers, who accumulated facts, and warned their students against the danger of premature theory upon mere infantine foundations; but as facts accumulated, these warnings were unheeded; the tendency to the human mind to theorise and to explain everything at once out of its own "innate ideas" at length overpowered caution; theory overwhelmed us like a flood, and the fruits of patient and diligent labour have been usurped by a body of fire-eaters, who assume that they have now completed the whole science of geology in perfection. They launch their excommunicating flames at every rebellious disciple who refuses to crown their dogmas with the motto "It is finished," and who still desire to proceed in the philosophical work of interrogating Nature, and dive if possible deeper into her secrets than the Geological Survey of Great Britain. The monotonous repetition in what are called geological papers of the "igneous" and the "glacial" theories, and the perseverance in excluding from any part of the discussion those condemned spirits who refuse to be dragged backwards and forwards between the two favourite extremes of dogma, force always upon my mind the graphic lines of Milton, as personifying the professors of our geological schools and the hapless rebels whom they condemn—

> "Thither by harpy-footed furies haled;
> At certain revolutions all the damned
> Are brought from raging fire to starve in ice—
> Immovable, infixed, and frozen round
> Periods of time, then hurried back to fire."

In the midst of this irrational tumult it is indeed gratifying to be relieved by the perusal of a letter which does intelligent and intelligible justice to the "globe which we inherit," and to the laws of its maker, seeking to establish harmony and order in the place of convulsion and discord.

It is nearly three centuries since the first scintillæ, of what we now call geology, were struck into light by the discussion raised by Fracastoro and others on the phenomena of marine shells embodied in the rocks of the Italian Alps at great heights above the sea level. The naturalists of the whole of Europe became involved in the discussion, which, as usual was ranged into two parties, with umpire theorists between. The observers could not resist the conviction that these remains must at one time have actually been covered by the sea. The haters of "new things" maintained they were mere semblances, forms created in the rock, or grown there by a concretion of humours. The theorists having the fear of Vesuvius and Etna immediately before their eyes, began to think of earthquakes and volcanoes as the only means by which the bottom of the sea could have been lifted mountains high. Meanwhile the knowledge of the strange fact increased by further observation in Italy and out of Italy, through the 17th century, until Liebnitz arose, with the usual felicity of a mathematician, to resolve the difficulty. He boldly taught that the earth, originally a molten bubble, had been shot out of a volcano in the sun; that this child of fire had gradually gained a skin by cooling; that the skin had thickened, and in contraction (strange physics) had compressed the inner fluid, which had broken through and formed depressions and elevations, &c., and out of this fiery waste, in due time, by sufficient cooling, all the beautiful variety of the existing earth and sea had proceeded—a few volcanos and earthquakes still remaining to give us a significant twinge, and occasionally remind us of the convulsive throes of our original birth.

Mathematicians, habituated to the trammels of rigid demonstration, have supplied philosophy with the greatest amount of extraordinary theory. Like men who have always needed a crutch in their locomotion, they indulge when it is thrown away the utmost eccentricity of mental movement. Meanwhile, the observation of facts proceeded in our country. Woodward, Mitchell, Martin, and others, in the last century, patiently observed and established the superposition of strata and of a variety of fossils indicating a variety of period. Werner did much abroad in the classification of rocks, after which the volcanic mania again broke forth, this time in England, in the person of another mathematician, Dr. Hutton. About the commencement of this century new fields of observation were opened to men of sense. The great invention of puddling and rolling iron by Henry Cort, at the close of the last century, caused immediately an immense development of mining in the carboniferous strata; the canals and tunnelling required in providing new means of transport by water and land increased the number of useful sections. Acting on these new data, the persevering intelligence of Dr. Wm. Smith, who, as an active practical man, had no time for vermicular theories, clearly established the succession of the sedimentary rocks from the old red sandstone, upwards through the carboniferous group, to the overlying new red and lias. This nucleus of the science of geology was pretty well established and received by the year 1810, soon after which I began to listen to the debates of the learning learned. The Mosaic deluge was at this time very much connected with the formation of the sedimentary strata, and every endeavour was made to make its action fit into the newly ascertained facts. Too young to speak, I perhaps thought the more, when, standing on some hill top with enthusiastic seniors, I listened to disquisitions how the torrents of the great flood had furrowed out the wandering valleys of our coal fields. That the gradual deepening of their branches from table lands, then uniting into deeper valleys, until the whole, joining in one gorge bestrewed with alluvium from the higher grounds, debouched upon some estuary, was the effect of watery action was plain to a child; but I could never reconcile how it was all effected by one passing flood over consolidated rocks. There was more appearance of the gradual action of slow water upon a softened surface. However, men can only put together such ideas as they have, and, under the strong desire of explaining, so inherent all, something is learned even by the failure of the attempt to make them fit in the absence of the key.

The next epoch in British geology was the investigation of the strata overlying the carboniferous group. In this Dr. Buckland took the lead, an enthusiast in action, but no fire-eater, in those early days. His discoveries of the tropical animals, of a certain class of measures, is a great geological fact, which will be appreciated when the Vulcanists are extinguished, or, at least sufficiently cooled down to look at the truths disclosed by this fact without their red spectacles. The comparative anatomists and conchologists aided the geologists. Mineralogy, developed by crystallography, accumulated permanent materials beyond the delusive and deluding touch of theory. Dr. Buckland convinced himself that the earlier theories of diluvial action were irreconcileable with the new accumulation of facts, and about this time Sir R. Murchison commenced the completion of the series of our sedimentary deposits by investigating the fossil succession of the other side of the carboniferous group, and tracing the organic relics downwards to their lowest antarctic types—another great feat which will be seen in their true value when learned eyes cease to be filled with fire.

In the meantime the disciples of Liebnitz and Hutton were not idle. The observers had ascertained superposition and elevation, and depression of tracts and continents, but they did not teach the *why* and *how*. Playfair, another mathematician, fell into the fire; foreign mathematicians, Poisson among the rest, took him out, and ascertained by the calculus the exact number of millions of years which had been consumed in reducing the surface of the igneous ball to its present temperature. Sir C. Lyell, in this country, flourished as an ardent champion of the fiery age. It then became a tacit arrangement between the two schools that the aqueists, as was indeed necessary, should retain all rocks evincing organic remains, and all those without their saving presence should be delivered to the flames. The globe was comfortably shared between the professors, in an offensive and defensive alliance, each giving the other support against all heretics. Neither to Liebnitz nor his followers did it ever appear to be worth while to explain how fire and water first came to dwell peaceably together. Their antagonism is even a vulgar proverb, but the philosopher is above vulgar considerations. An ocean covering more than three-fifths of its surface, settled down at once without the least disturbance upon a globe of incandescent lava, there were no convulsions, not even the gentlest ebullition. On the contrary, the deeper and nearer the fire the ocean is penetrated, the colder the water is found—a fact the theorists have not yet explained. A few cuticular blotches, or irregular pimples, called volcanoes, scattered at remote distances over the vast surface of the land, were studied by the geological doctors as the vital organs; the anatomy of the terrestrial body was sought for by dissecting carefully these superficial pustules, as exhibiting the energy, the seat, and the laws, of healthy life; a reasonable course, further only to be paralleled with the wisdom of a vegetable physiologist who should profess to explain the processes in the growth of a tree, the formation of wood, bark, leaves, roots, sap, and its absorption of nutriment, by attention to nothing but the diseased exudations of its gum.

I think we are as much indebted to Sir C. Lyell as to any writer for the reception of this igneous dream. Out of his researches into European volcanoes and their remains are certainly derived the greater part of the evidence, such as it is, which the igneists rely on. But had he attended to the evidence on the other side, even to that furnished by his own quotations from various authors, the progress of geological science might have been spared the hindrance of a theory, which is now, and has long been its greatest obstacle. He quotes a passage from Strabo, upon the mobility, pliability, or plasticity, of the main mass of the earth at great depths, where it is saturated with water, which might well have been written by your correspondent himself. But no other way having occurred to the lovers of this science to account for the elevation and depression of continents, except by earthquakes and volcanic action, it was determined that all doubtful phenomena must be accounted for that way; and that way they have been accounted for, even to the extreme absurdity of teaching that small streams of lava could be forced up in a fused state through the crevices of rocks filled with water, still retaining sufficient fluidity to flow over adjoining tracts of country, passing through beds of coal without firing them, and through limestone without discharging its carbonic acid, wound up by the final monstrosity of teaching that our crystallised mineral veins, containing various metals and earths, in every kind of chemical union and disunion, have been forced up in a fused state from some vast reservoir of molten metals in the earth below. This is no wild and exploded theory, as we might conceive, of the dark ages—it was actually taught by the late lamented Sir H. De la Beche, and applied by him for the instruction and guidance of mining in Cornwall.

Now, how is it to be explained, that a science commenced with so much caution, with so prudential a reserve of venturing on premature theories, which I know of my personal knowledge to have been the habitual views of the founders of the science, should all of a sudden come to a dead stop in its progress, and its professors refuse resolutely to learn any more? This is the actual fact: the discoveries made in geology *proper*, during the past 15 or 20 years, in which the igneous delusion has been acquiring such a metallic consolidation, made in strict accordance with the facts of mineralogy, crystallography, and the vast accession to physical science accumulated by the labours of Faraday and others, are equal in value to all that had previously been done since the commencement of the science 50 years ago. But, in spite of the extraordinary progress of chemistry, and every branch of natural science, and the unthought of revelations of magnetism, the professors of geology shut out all light, and obstinately pin their faith and the minds of their pupils on the antique ideas of Liebnitz, framed at a date when our knowledge of the elements was confined to the four terms—earth, air, fire, water. I fear this assumed *finality* in the advance of so useful a science, the refusal to learn any more, is very much caused by the routine necessity which is inseparable from Government offices. Since the completion of the Geological Survey of Great Britain, which is a map of the surface, the science has assumed a mere superficial character. Professors, established by authority to teach, are naturally supposed to know all their subject; they must not appear at a loss to their pupils; and thus a study quite in its infancy, and which had always been so acknowledged, has been brought to rank with the definite rules of arithmetic, writing, and other old matters well established, which no one holds any doubt about. The science being closed, discussion is at an end; no new views, based upon the facts which lovers of truth collected, for the very purpose of leading minds to new and more perfect truths, can be listened to. They must not be heard, because they would disturb the routine of the seminary—immortal science is subjected to a military discipline; the orders of the general in command are paramount; according to his own views of office he decrees "Thus far shalt thou go and no farther." This may have been necessary for a time, but there is now such a flood of counter-truth accumulating that the routine, ere long, must be altered, the school-books reformed, and made consistent with the progress made in geology during the last 20 years. I may be said to have received its study by inheritance; and, deeply interested in its progress, I look upon the admirable remarks of your correspondent as heralding the dawn of improvement. I hail them with the greatest gratification. DAVID MUSHET.

THEORETICAL IRON MAKERS.

SIR,—I think your correspondent, Mr. Reveley, must be an engineer who went to the Cape about 30 years since, and was then known to me. I think he will find he has made a miscalculation as to Mr. Hall's legs, and discover his argument to be carried on a very substantial understanding. I was excessively interested with a letter published about two months since, by Mr. Hall, in the *Birmingham Journal*, and subsequently noticed in your columns. It contains a mass of practical information of the most valuable kind, and exhibits, besides, a sterling worth and honesty of character most gratifying in these slipslop times of scheming speculators. Such men are the right English stuff, out of which English greatness has been made and maintained. When we are surrounded by public rascals, who set themselves forth as moral, benevolent, and even pious men, directors of banks, directors of joint stocks, governors of charities, trustees of female penitentiaries, who do their best to make penitents for their service by driving families to ruin through their fraudulent schemes—patrons of young men's christian associations, who carry out their principles by suborning the clerks and secretaries in their own offices to the commission of perjury—disreputable high sheriffs of counties, who amass wealth by illegal usury, collected by trick and force, abusing the confidence of an employer, who commit frauds with deeds, and in their term of office can place the rope round no man's neck so worthy of it as their own, conspiring with parsons who embezzle trust-money, and by corruption and threats induce clerks respectably connected to conceal the evidence of their fraud—lawyers who wink at and assist in all these things, with the whole frightful scum, which ill-gotten wealth, and the hankering after it, floats upward to daub over and defile the public face of society—it is gratifying, indeed, to read of such men as Mr. Hall, who have made money honestly, with a resolute heart, and at a sacrifice of his own gain to the integrity of duty. It is such men who have made our country what it is; whilst the froth of rascals and hypocritical ruffians seeks publicity on the surface, it is the pure metal of such characters, deep beneath, aggregated together, and the more valuable as less seen, that saves and supports our nation from the ruinous corruption and corrosion of the bubbling and ostentatious scoria of society. It is these men who are the true pillars of the state, in their honest and intelligent elevation, and are both the founders and foundation of our worthy social fabric. I have been very anxious, had time permitted, to make some remarks on Mr. Hall's letter in the *Birmingham Journal*. It appears he was the inventor of the boiling process of puddling, a fact I am the more pleased to hear because I have long endeavoured in vain to ascertain who was the inventor. The date of the invention is much earlier than I had any idea of, long before it was adopted in Wales. I intend when I can to revert to this subject, for the purpose of gaining further information; there is nothing can do this country less credit, with all its swarms of literary men and professors professing everything, than the fact of the origin of any of the processes used in our great staple—the iron-making business—being suffered to remain in obscurity and unrecorded. Meanwhile, if Mr. Reveley knew as much of the Bloomfield manufacture of iron as I do, he would have seen better reasons than he has assigned why a theoretical iron-maker should shrink from accepting Mr. Hall's wager. DAVID MUSHET.

Nov. 18.

STRATIFICATION.

SIR,—It has been frequently made a matter of reproach against geologists that they have devoted too much exclusive attention to the fossiliferous rocks, and the organic remains which they contain; but at present a new school is rising up, who would appear to ignore the very existence of such phenomena, even whilst investigating subjects on which they have the most direct bearing. That this school should find many adherents amongst persons connected with mining is but natural, as the attention of such persons is very frequently chiefly directed to rocks and strata in which organic remains are not found; but from whatever cause, such passing over an immense class of facts is most prejudicial to geological enquiry, for no one can hope to read aright the book of Nature who either wantonly or carelessly leaves unscanned one of its most important and interesting pages.

The theory or hypothesis that the beds or strata of which a great majority of known rocks consist are marks of deposition by water does not rest alone upon the fact that we find such beds or strata at the present time deposited by water charged with sediment, as in the case of rivers, estuaries, lakes, &c., but is also supported by all the facts known in reference to fossil remains. Hence, those persons who would turn to electro-galvanism as the key which will solve all the problems of geology, must remember that it is not enough to prove by experiments on a minute scale that beds or strata of mixed materials may be produced by such forces, and thence to explain the whole phenomena of stratification, unless at the same time they can explain, by the same means, the deposition and preservation of organic remains.

The argument in favour of the aqueous deposition of certain rocks founded upon fossils is very simple, and to me appears conclusive. We find innumerable specimens of the animal and vegetable kingdoms entombed in various rocks—their materials and chemical constitution changed, it is true, and that in a manner with which we are not acquainted, but still preserving their original form in its most minute and delicate parts—the fibre of a bone—the cellular tissue of a plant—the convolutions of a shell. Now, either we must go back to the dogmas of the earliest Italian geologists, and, believing them to be caused by a certain plastic force of Nature, accuse, in fact, the Creator of a practical joke, and believe that some of the most marked characters in which the records of his power are written are forgeries and delusions; or else we must believe that these fossils are really remains, chemically changed, of actual living animals, whose lives were governed by natural laws, more or less nearly resembling those in force at the present day.

Now, even putting aside the incontrovertible argument that some such strata have been formed by aqueous deposition, afforded by the presence alone in them of fishes, shells, and other aquatic remains, how, in the case of terrestrial remains, can we suppose them entombed and preserved so uninjured in their tenderest parts but (except in case of volcanic action, the characteristics of which are peculiar and unmistakeable) by the slow and gradual deposition over them of a sedimentary deposit? Be it remembered, also, that these remains are not merely found in beds either quite or nearly horizontal, but are found in strata inclined at every angle, and in every species of contortion. Now, if we admit, as I think every one must do, that such fossils have been originally covered by sediment, we cannot suppose them to have been so covered in a very contorted or highly inclined plane, and we know it to be absolutely impossible that they should have been so covered in a vertical plane. Hence, we fairly conclude that, having been originally deposited in a bed more or less nearly horizontal, the bed must since have, by some means or the other, been forced into contortions, or into an inclined position. By what means this may have been effected is not the subject of this letter.

If, therefore, we allow that a fossil shell once contained a fish, or that a fossil bone ever belonged to an animal, we must allow that some beds containing these were originally deposited by water, and that some of them were, after their deposition, violently contorted, lifted up, and depressed. This once admitted, the geologist is perfectly logical in assuming the same as to all beds in which the appearances are the same, even when not containing fossils, until some better hypothesis is raised. If, on the other hand, you assume an electro-galvanic action as the cause of stratification in the metamorphic or non-fossiliferous rocks, you must either show that the same cause will account for the entombing and preservation of fossils, or else you assume two causes for similar phenomena, when one alone will suffice—a proceeding against every rule of true science.

I admit that, to a person who has chiefly or only seen strata destitute of fossils, who is accustomed to see such strata inclined at every direction to the horizon, and twisted about in every way, it does appear strange to refer such strata to the gentle action of sedimentary deposit. But let such a person mark the similarity in all mechanical points between such beds and those containing fossils; let him see the latter in equally disturbed and inclined positions, and then reason on the manner in which these fossils—these "medals of creation"—must have been preserved, and he will soon be forced to admit the at first startling fact.

In many cases, the fossiliferous strata pass insensibly into the non-fossiliferous; in all cases there are sufficient points of resemblance in the mechanical aggregation of the beds to allow us to reason from one to the other. In fossils we have, as it were, eye-witnesses of the convulsions of former ages, and who, though dumb, can still bear eloquent testimony to the manner in which they were formed, and the revolutions they have since undergone. Like the inscriptions on the Rosetta stone, they are the link connecting the known and the unknown, by which alone a clue to the hieroglyphics can be found. Those who pertly accuse geologists of wasting their labours on shells and bones would do well to learn their true significance, and to try to rival at least the industry and zeal which have been devoted to this important subject.

That most, if not all, rocks have been acted on by electro-chemical action is most probable; but such action can never be taken for the chief agent in stratification till it is also shown that it will equally account for the formation and preservation of organic remains.—*Kyle, Ecuiscorthy, Nov.* 17. A. H. PATTERSON, C.E.

TRIAL OF PATENT CAUSES.—No. VII.

SIR,—I concluded my last letter, by affirming the economy of the proposed plan of substituting a preliminary report, under the authority of the Patent Commissioners, for the ordinary conflict of scientific witnesses. Although I am, of course, unaware of the precise scale of fees that would be fixed; yet, so far as I can judge from what it appears to me would require to be done, and the rates of the present charges to patentees for assistance rendered to them, I have no doubt that there would be a considerable direct saving in every case. What was paid for would have a more direct effect on the ultimate issue of the cause than can now be secured, and then indirectly it would produce a great saving by its tendency to shorten the duration of the proceedings, by leaving fewer points open for appeal and new trials, a result that would be likely to increase with the growing maturity of the system. Besides, it would be possible to calculate beforehand the probable cost of obtaining the report, a matter of no slight importance to the parties in a patent cause, and thereby obviating much of the present inconvenience of their being gradually drawn into unavoidable expenses in an unforeseen extent.

However, without dwelling any further on the point of economy, which to me appears indisputable, I will proceed to consider the proposed plan as a whole, with a view of indicating still more strongly "the probable intrinsic quality of the preliminary report," which is, after all, the chief point to be fully apprehended in its bearing upon the improvement of the tribunal for patent causes.

In every case a patent defined by the terms of a specification forms the subject of preliminary enquiry. The invention so defined is either old or new, and is of more or less value. It is taken as new unless it be shown to be old, and its value is only incidentally a matter of enquiry, with a view of determining that it has a substantive feature, by which it can be distinguished from all that preceded it. The mere fact of the parties thinking the invention worth contesting, is evidence enough for all practical purposes that it has some value. The only needful preliminary enquiry then, in all cases, simply amounts to this—Is the invention, as defined in the specification, new, for aught that appears to the contrary, or is it shown to be old? Is it really a substantive invention; or is it proved to have no existence in fact, but to be a mere statement in a document?

Now, the proposed report is intended to resolve these points, reserving all the rights of the parties to be dealt with, just as if the case involved no scientific points, except that the Court might, if they saw cause, from the evidence submitted to them, reject or modify the report. Except, in a few instances, however, I think the Court would accept the report; for judges very naturally shrink from pronouncing opinions on points which they are not necessarily called upon to decide; and it is probable that the evidence, subsequently given in open court, would not often be held to be of such weight as to disturb the conclusions expressed in the report. Besides, in cases in which important exceptions were intended to be taken to the report, if might be convenient for the officer of the Patent Commissioners to attend in Court, and render such assistance as might be thought necessary to the judge in determining the effect of the scientific evidence adverse to the report, before he summed up the case.

It will thus be evident that there is no real necessity for any formal and artificial pleading in this preliminary stage of the proceedings—indeed, that it is better dispensed with. As there is no particular form required by law for the specification, like other legal documents, and as its language "is necessarily that of the factory," and its illustrations such as few lawyers are conversant with, it appears to me a natural consequence, that a proper enquiry into preliminary scientific points urged for and against the specification, requires to be unfettered by the ordinary rules of legal pleading, which have been framed principally, if not entirely, to meet the case of trying the contents of documents having a settled legal form.

Assuming, however, the preliminary report to be given in decisive terms, against which no weighty scientific objections could be urged on either side, a determinate case would then be open for trial, as to legal rights, in the ordinary way. The function of the pleader would now come into exercise. But he would have to deal only with points that were amenable to the rules of pleading. He would take the scientific points, as settled by authority, and only to be assumed in the pleadings. He would, therefore, be in a position to concentrate his efforts upon the construction and development of the strictly legal bearings of the case. In this manner his work would tell with more force in Court. The examination and cross-examination of witnesses would be more pointed and intelligible. The judge, too, would have a settled point of view from which to regard the law of the case, and to guide the jury in their determination of the facts; and the jury would only have to apply their minds to matters of fact.

It is obvious, therefore, that the whole weight of the proposed plan rests upon the intrinsic quality of the preliminary report—upon its trustworthiness as a guide to the science of the case: this is the fulcrum for the proposed lever. The whole plan must fail, were there no reasonable grounds for expecting the possibility of getting a satisfactory report. But what reason is there for doubting even the probability of obtaining such a document, especially when we remember that the standard by which it is to be tried, is not that of absolute (hyper-critical) perfection, but perfection as compared with the system of a conflict of scientific testimony? WILLIAM SPENCE.

Office for Patents, 50, Chancery-lane, Nov 15.

THE LIBERTY MINES, IN VIRGINIA.

In our last Journal we inserted an abstract of the following letter from Mr. Gregg, to a shareholder in these mines, promising the letter *in extenso*:—Mr. Gregg says:—

The best answer that I can give to your letter will be to run over the history and position of the mine since my connection with it; touching most markedly upon those points which seem chiefly to have attracted your attention. When I arrived at Vaucluse, I proceeded, as you will have learned from the report of last March—1. To pay off the indebtedness; 2. To examine into the capabilities of the mine; and, 3. To disencumber the mine of expensive but unnecessary labour. 1. The amount of money I brought with me, and that I afterwards received from England, was not sufficient to liquidate the liabilities of the mine, but left a sum of at least $10,000 still owing, on which interest and cost have been since accruing. The mere fact of paying off a portion of the indebtedness did not place the mine in good credit, but left me—so far as engaging a sufficient force, and making necessary improvements were concerned—as helpless as ever. Without good credit no business even in wealthy England can succeed; but gold mining without good credit in poor Virginia is, believe me, a difficult and somewhat arduous task. I have had, indeed, to resort to all kinds of business expedients to keep the mine from stopping; and, in spite of the evils necessarily arising from a contracted credit—from want of means to sink a shaft—to repair the engine—and to renovate the eighteen stamps to which you refer, and which have ever been since my arrival here so much out of order as to be incapable of being run,—in spite, I say, of all this, by improvements which I have made in the working of the mine, the company has been prevented from incurring loss, and is now, when the workings under ground are taken into consideration, in a much more favourable position than it was last January.

You will remember that, on page 12 of my report of last April, I distinctly intimated that all that could be expected of the mine, unless the shareholders would supply the necessary means for carrying out the improvements I therein suggested, would be its being able to keep itself from running further in debt. This opinion has not only been continually reiterated by me in letters to the board, but has to the present time been sustained by the working of the mine; for, although the mine has not yielded any money profit as yet, yet, as I predicted, it has hitherto paid all expenses attending its working since I assumed its management; and, I may add, that if the sulphurets which I have saved by labour already paid for had been reduced, I should have been able to have informed you that the indebtedness of the mine was now considerably below ($10,000) the sum I have named. I may be excused attracting your attention to the fact that, under nearly the same circumstances last year, the mine for some months lost at the rate of $1000 per month, and this without Mr. Crosse's salary being charged, while now each month's expenses are generally met by each month's receipts.

2. The capabilities of the mine, as I stated them in my report of March last, are, in my estimation, fully as great now as then; though, as a matter of course, my views from a greater and more prolonged experience of the practical working of this individual mine, have undergone some modifications: and while I should reduce the returns in some particulars, I should now increase them in others. Yet, on the whole, I believe the prospects for the shareholders to be as brilliant as I have ever represented them to be. The ore, as I supposed, has ever since the mill started this year proved itself to be worth, exclusive of all benefits to be derived from the sulphurets, nearly $2·52 per ton, a sum which will be amply remunerative so soon as I am able to work the mine with a force adequate to run the 42 heads of stamps for 20 hours per day. When I first came, the 18 stamps were out of order—utterly incapable of being run at all; but this difficulty might have been overcome, by expending a portion of the money sent to pay off the indebtedness in repairs and renewals. Unfortunately, however, this was not the whole of the difficulty: to run these 18 heads and the 24 (which were in tolerably good order), I should have had to repair the engine, at a serious cost and delay. But even, perhaps, the cost, formidable as it was considering the financial position of the mine, might not have prevented my having this done, but the necessity which existed for my wearing from the working of the ore the necessary funds for paying hire, wages, and the keep of negroes and horses, rendered this utterly impossible. In one word, the delay that would have ensued from repairing the engine would have so embarrassed the mine as to have rendered it extremely problematical whether we ever got to work again or not; for if we did not make ready money by stamping, to meet our expenses, the hands would have been taken away, and suits brought against us. Looking carefully back during the past few months, knowing as I do the great disadvantages here attending any concern in debt, and feeling those disadvantages daily, I cannot for one moment believe that I erred in setting the mill, as it was, at once to work; trusting, as I am sure I may do, the shareholders' own judgment for sending me sufficient means to enable me during the bad weather of the coming season not only to repair the engine, and do other necessary outside work, but to pay for the hire and the food of the necessary labouring force.

3. The expenses of the mine per month, with, on the whole, a larger return of gold, have been considerably reduced, and this must be as great a subject of congratulation to the shareholders as it certainly is to me. The expenses of a mine like this can always be made to appear to be reduced. This is done by taking out ore which by previous la-

bour is brought into sight. It is this that made the returns of the last few months of last year appear to be greater than they were previous to Mr. Crosse's departure for England. When I came here, I found that nearly all the ore in the then levels had been taken out, and hence it became necessary to drive new drifts, and open out fresh ore. This I have done with the reduced force, and still kept up my returns to the point which has enabled me to pay from them all the legitimate expenses of working the mine.

With reference to my not having made any arrangements with Dr. Holland for the working of the sulphurets, you must remember the condition of things at the mine on my arrival. I found that no works had as yet been commenced, and I thought that until some really practical demonstration had been made, it would be worse than folly to attempt to tie the company down to any disadvantageous arrangement, which, while it would deprive the company of the control of its sulphurets, would also impede the regular working of the mine. American patents must at all times be looked upon with some suspicion. Of this particular patent I had some very natural suspicions, which were rather increased than diminished by the fact that I found for some time all turned upon a money payment from the company to the patentees. When I rejected this, one-half of the profits were offered to be taken, provided the whole of the management of working the patent was given up to them. This would have interfered with the legitimate working of the mine; and, moreover, I could never be assured of really receiving the half of the profits belonging to the company, for dispute might have arisen as to what were the expenses. From the first, I had been incredulous as to Dr. Holland's process being the best obtainable one for reducing the sulphurets. On this point I had some conversation with Mr. Reeves, a tolerable chemist, and the representative of Dr. Holland. In spite of all attempts to bring matters to a conclusion, such as the company would approve, and I feel justified in making, the patentees hung back, and this they did although the process was nowhere in operation, and notwithstanding they had failed in introducing it at other mines.

At last, owing partially to their inability to pay Mr. Reeves for his services, a quarrel broke out amongst the whole party, and I again had a conversation with Mr. Reeves on the various means of getting at the gold in the sulphurets, and obtaining at the same time paint, &c. Feeling at liberty now to speak openly on this head, Mr. Reeves offered to give me every information. I discovered that Dr. Holland's process was found on a large scale—so far as a mine was concerned—impracticable, on account of the heavy expenses attending its operation. Mr. Reeves, however, explained to me how, in the course of his experiments on our sulphurets, he had discovered a practical mode of working them, and this he has since put into practical operation on a scale sufficiently extensive to convince me of its full success. From him I have received a proposal, which I have already forwarded to the company, and which, doubtless, you have already seen. I forward by the present mail also a specimen of the paint made by Mr. Reeves, and which is superior to that made by using Dr. Holland's process.

I have already explained to the directors, and shall more fully set forth in my report to the next meeting of shareholders, the grounds which I have for believing that the mine will be a brilliantly paying concern. It is possibly sufficient for me to say here that inasmuch as the present expenses in conducting the mine would, by doubling the present labouring force, be only increased by one-half, while the returns would be more than doubled, and that since the present returns are nearly, if not quite, equal to the expenses, it follows as a matter of course that a profit would be made, and this profit on the free gold alone would amount to at least $10,000 per year. This is certainly not so much as the estimate made by Mr. Crosse, in the report which you send me. I have always wished, however, in any statements I have made, either to the board or shareholders, not only to adhere strictly to what are the facts, but at the same time simply to state what I am confident of being able to carry out, when properly supported by the directors and shareholders. This profit of $10,000 per year I should expect to see doubled as soon as the sulphurets are worked; and, indeed, the shareholders need not fear this result being obtained, if they will only enable me to relieve the mine of its indebtedness, to repair the engine, and to work the sulphurets as proposed by Mr. Reeves. Had I made, I should mention, any arrangement for working the sulphurets before I had been able to find out what I have already explained, there is no doubt but that the mine would have lost fully $50,000.

I must apologise for the length to which my letter has run, but there were so many points to touch upon, and from your letter I could see that the true position of things here, was certainly but poorly understood by you and other shareholders, that I have thought it best to write—to write as I felt. Even as it is, there are still some points untouched; but from a careful perusal of my late letters to the board, I trust you will be able to see that there is every chance of the mine becoming very profitable to the shareholders. As it is, this year this mine has been the most successful of any in the neighbourhood. The other mines are still actively pushed forward, and not one in so forward and promising a condition as Vaucluse; and were I not thoroughly convinced that, by adopting the course I have pointed out to the directors, the mine will pay handsomely, I certainly should refuse any longer to have the management of it here, since the salary I am receiving would not pay me for the superintendence of a losing concern.

You say that many of the shareholders anticipated great results from my mission to the mine and undertaking its superintendence, but that they were fast losing confidence in my predictions. Have I not carried out all my promises? Is not the fact of the expenses this year being only half what they were last year (and $10,000 per annum less), taken with the fact that we have made 34 ozs. of refined gold more this year than we did last year in the same time, a satisfactory proof that I have benefited the company? Last year there was a heavy loss, this year there will be none.

If the late arrangements for working the sulphurets, according to the contract made by Mr. Crosse with the patentees of Dr. Holland's process (and which contract was considered legally binding when I came here), had been carried out, the company would not have made anything from the sulphurets for five years to come. Now, if they work extensively according to the new arrangement, proposed by Mr. Reeves, they may make at least $50,000.

I shall always feel much pleasure in replying to any communication you may think proper to favour me with, and as I wish a proper understanding to subsist with all those I act for, I shall feel obliged by your explaining to the directors and shareholders the disadvantages under which I labour now, and the benefits which they might secure by working the mine on an extensive scale.

S. G. Gregg.

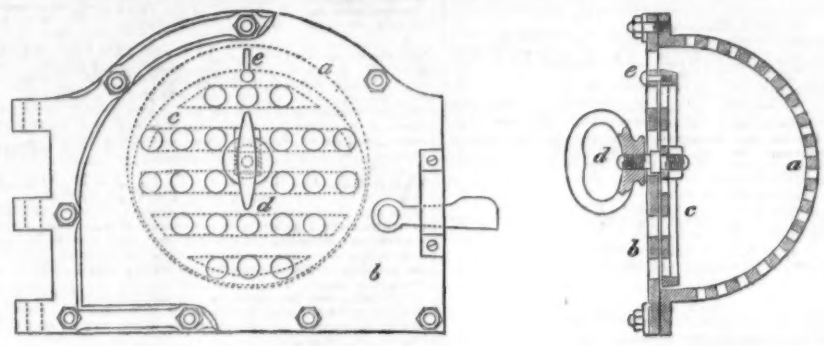
Vaucluse Gold Mines, Oct. 8.

P.S.—You refer to the Mariquita and St. John del Rey Mines. It may, perhaps, be that there are some points of resemblance which would justify a comparison with this, yet you should remember that the St. John del Rey is worked on a very extensive scale, and that before the mine was fully opened out no profit was made, for that company spent nearly $1,000,000 before they made any returns, and they would probably never have made any had not the shareholders advanced $10,000. Comparatively small aid only will be necessary to ensure similar success to this undertaking. I shall base my report on actual facts and figures, all of which I have not yet collated, but this letter and my report will, I hope, be satisfactory to you.

ON GRANITE FORMATIONS.

At the Royal Geological Society of Cornwall meeting Mr. Enys read a paper on the Granite Formations, in which he referred to a former paper on the character and direction of the joints or divisional planes found in the chalk near Beechy Head. He had remarked the similarity in this respect of the chalk and granite districts. He referred to the granite structure of the Scilly and to the district of Penryn, west of Penzance, near Bodmin, and at the Cheesewring. He pointed out the coincidence of the lines of valleys with the N.N.W. joints, and afterwards proceeded to show the marked difference of rock scenery produced by the inclination of the joints to each other, there being the wall or square structure, the needle or angular, and the nearly horizontal or domed formation of the bedway, which gives occassionally an appearance of a deposit of layers of granite. He quoted from Mr. Hunt upon the subject, and especially remarked upon the dome-like character of granite in its influence on scenery. In the discussion which took place after the paper was read, Mr. Couch remarked that in St. Just, near Cape Cornwall, at Boswedden Mine, the granite below was very hard, but on its being brought to surface and exposed to the air it could be broken with the fingers; it crumbled down in such a manner that it could be made to take any form by exposing any particular point to the weather. The water, too, in that district had such an effect on iron tubing, pumps, and other apparatus, that cast-iron could be cut with a knife; and if iron were thus acted on, it might be well supposed that atmospheric influence, with the chemical character of the water, would be at least equally powerful on granite. Mr. Carne believed the Cheesewring was a specimen of decomposition of horizontal rocks. Mr. T. S. Bolitho observed that at the next tor, about 1½ mile distant, the joints were perfectly perpendicular. Mr. R. Hunt, F.R.S., had visited the Cheesewring, and with the Messrs. Enys and Freeman, the quarries near Penryn. It seemed to him there was one point in connection with the granite formation which had not received so much attention as it deserved. There had been a general idea that the form of a granite hill corresponds with the structure beneath that hill, and that the round, swelling form of granite hills might be represented as one great granitic bubble—the heaving up of one great granitic mass. But, certainly, on visiting, in the first instance, the quarries of the Cheesewring, it was evident that the great hill there was made up of a number of these domes—each dome putting on an appearance of concentric layers, like the layers of an onion. At Penryn it was a similar formation. It appeared to him that by careful observations of the conditions of doming granite they might arrive at some explanation of the peculiar forms of our granitic valleys. Some years ago his attention was called to some granite brought from the bottom of Tresavean Mine, a depth of 310 fms. below adit, or 350 fms. from surface: it was exceedingly hard, but 24 hours after being brought to surface it was found to crumble up. Capt. Jennings, who first called his attention to the matter, imagined that it was due to the drying of the granite by the action of the atmosphere. But it occurred to him (Mr. Hunt), seeing the large character of the felspar crystals, that it was likely to be due to the different expansive power of the constituents of the rock. He took a portion of the granite, which was at surface undergoing this gradual breaking up, and put it in an oven at the account-house, and found that, with a temperature of 100° (which it originally possessed in the mine) or a few degrees above, the granite became as hard as at first. We had been in the habit of looking on granite as a rock of igneous origin; but there was one point which, it appeared to him, had been overlooked in examining that question. If we took the green-stone rocks, which were evidently of igneous origin, nearly all of them contained protoxide of iron, which was never the case with granite rocks, where the iron was found in a state of peroxide. This difference in the condition of the iron in the two rocks had struck him very forcibly, and he mentioned it now to call attention to the fact. Mr. Henwood observed that every mine captain knew that sometimes ground which was exceedingly hard to be penetrated, even remaining *in situ* and at nearly the same temperature, would, after the mine had been opened, decompose and become soft. Granite, killas, and other rocks very hard to be penetrated, after some few months, or weeks, or even days, had become so soft as to require timber to support them. He mentioned this, thinking that something besides temperature might affect them. Whatever was the cause, it was a cause that operated not exclusively at surface. These were facts well known to practical men. He did not make any theory on the subject. Mr. Hunt was aware of the decomposition *in situ*, to which Mr. Henwood had alluded, and his own impression had been that where that had taken place the rocks had generally contained an unusually large quantity of silicate of potass, or some of the alkaline salts. In some instances in the Penryn granite the quantity of potass contained was so great that it was contemplated to make potass from the granite as a commercial project. Mr. Pengelly and Mr. Carne then addressed the meeting, and thanks were voted to Mr. Enys, who replied that he thought he deserved thanks for having caused a discussion on joints, but observed that the title of his paper was very different.

REGULATING AIR-DOOR FOR BOILERS, Etc.



Mr. Lee Stevens has added another practical illustration to his series of successful inventions in the subversion of smoke and corresponding increase of combustion; which, it appears to us, must be quite as applicable to locomotive and stationary as it is proved to be to marine boilers. This new adjunct to his system of smoke-prevention and economy of fuel he calls "The Patent Regulating Air-Door;" and we are enabled to give the public, through the medium of the *Mining Journal*, the earliest description of it, which accurately represents the invention as attached to the steam-boiler of the *Sir Robert Peel*, accompanied by official reports in testimony of its smoke-preventing and steam-increasing effect.

By reference to the diagrams, it will be seen that the Patent Regulating Air-door consists of an inner and hemispherical compartment, *a a*; an external door-plate, *b b*; and an intermediate adjusting plate, *c c*, which can be fixed in any required position by the handle *d d*, the guide-pin, *e e*, keeping the slots of the plate *c* parallel with the apertures in the plate *b*. So constructed, the patent regulating air-door, whether applied to the combustion-chamber of the inventor's patent marine boiler, or to any other form of steam-boiler, or in substitution of ordinary furnace-doors, presents the following advantages:—

1. Adaptability to the use of every kind of coal, from the least to the most bituminous qualities.
2. Prevention of smoke, by adjusting and fixing the air apparatus to suit the quality of coal.
3. Economy of fuel, from increase of steam; by the continued admission of air, regulated to the quantity required to cut off the smoke in about half a minute.
4. Simplicity and cheapness of construction.
5. Durability, by comparison with any other description of fire-door; the inner and hemispherical compartment, combined with the air-regulating arrangement, presenting the most effectual means of resisting extreme heat, as well as of the liability to fracture from expansion and contraction.
6. Improved ventilation of the boiler-room or stoking-hole.
7. Facility of adjustment; the outer door-plate and the handle keeping constantly cool, with less than half a turn of the latter the regulating plate can be altered and fixed in a moment.
8. Simplicity of action, requiring no interference whatever with the furnace itself, nor any extra or unusual attention on the part of the firemen or stoker.

This invention, therefore, provides the long-desired means of regulating the admission of air, so as effectually to inflame the carbonaceous gases, and produce the most perfectly attainable combustion, agreeably with the more or less bituminous (or smoke-producing) nature of the coal; and to increase or diminish that supply according to any change in the quality of the fuel that may happen to occur. Whilst, concurrently with the subversion of smoke, the production of steam is stimulated to the extent of effecting a saving of from 10 to 20 per cent. in the consumption of fuel, varying with the particular descriptions of coal in use.

In proof of the efficiency of this invention, reference is made to the following communication from W. B. Lambert, Esq., superintending engineer to the General Screw Steam Shipping Company, and the report of the chief engineer on board the *Sir Robert Peel*, which screw steamer has now been placed on their trade between London and Dunkirk by Messrs. W. H. Carey and Son:—

[COPY.]

"*General Screw Steam Shipping Company, Southampton, Nov.* 10.

"Dear Sir,—In answer to your enquiry, I regret to say that I have not had an opportunity of personally testing the efficiency of the patent smoke-consuming fire-doors, on your principle, which were fitted to the *Sir Robert Peel's* boiler, here; but I have much pleasure in enclosing a copy of the chief engineer's report to me, by which I am glad to learn that they answer the purpose intended, and are, as you anticipated, of assistance in keeping steam.

"I am, dear sir, yours very faithfully,

"J. Lee Stevens, Esq., London." (Signed) "W. B. Lambert.

[COPY.] "*London, Nov.* 6, 1856.

"Sir,—With Mr. Lee Stevens's regulating air-door, on board the *Sir Robert Peel*, we can entirely exclude, or admit as little or as much air as will suit different qualities of coal; and we can cut off the smoke in a few seconds. As regards steam, I was quite satisfied with the trial on our second voyage. We blow off at 12 lbs., and our pressure having gradually lowered to about 10 lbs., with the air-apertures closed, it immediately recovered the difference when they were opened to the proper extent for cutting off the smoke, at which we now keep them. The invention has the further advantage of helping to ventilate the stoking-hole, for, when the air-apertures are open, the door-plates and handles are effectually cooled; and it must be as durable as it is simple.

"I am, Sir, your obedient servant,

(Signed) "Chas. Musgrave, chief engineer.

"W. B. Lambert, Esq., General Screw Steam Shipping Company, Southampton."

We cannot conceive anything more satisfactory than the disinterested evidence thus given of the perfect action of the Patent Regulating Air Door, as far as marine boilers are concerned; nor can we discover the least difficulty in its adaptation not only to stationary boilers of every form, but to *locomotive boilers* also, as a means of substituting the use of coal for the more expensive coke; whilst we have no doubt of its equal applicability to furnaces for all kinds of manufacturing purposes, in preference to the ordinary or any other description of fire-door. And we, therefore, anticipate such an extensive patronage of this simple, yet not less ingenious and useful, invention of Mr. Lee Stevens, as will adequately reward him for his constructive talent and industrial energy.

THE LATE JAMES HANN, THE SELF-TAUGHT MATHEMATICIAN.

This distinguished mathematician was born near Washington, in what is still known as the "Lane House," in the county of Durham, about the year 1799. We have heard him say that his father was the master smith at Washington Colliery, though how long he held that situation after the birth of his only son James we know not for certainty, but are inclined to believe that he shortly afterwards removed to Hebburn, on the banks of the Tyne, where he superintended the old pumping-engine, his son performing the duties of stoker. Certain it is that, like most boys in this locality, at the period we are writing of, James was taken from school at a very early age, so that we imagine he could barely read and write when he began to work; and he continued in this state of ignorance for some years longer, manifesting none of that precocity which is usually recorded in the lives of great men. He became, probably from the circumstances in which he was placed, passionately fond of music, and devoted all his leisure hours in learning to play on the violin. Thus it was not until he had arrived at the age of maturity, and had taken to himself a wife, in his own station of life, that his mathematical genius began to develop itself. At that period, however, a working man had none of those advantages for study which are now offered by mechanics' institutes, philosophical societies, schools of art, and, more than all, cheap and useful text-books on the pure and physical sciences; but a genius like his was not to be deterred by what to others would have been insuperable difficulties. Whilst still working winding-engines for drawing coals at various places, he read all the works on mathematics which he could procure; but how difficult a matter it was for him to procure books will be best understood from the following anecdote, which he occasionally related to his friends:—

Whilst still an engineer in one of the small steam-tugs which plied on the Tyne, he landed at the quay side of Newcastle, and in walking along came to the shop of a dealer in second-hand books. His eyes wandered rapidly over the collection, until they became fixed on a soiled copy of Dr. Gregory's *Mathematics for Practical Men*, which was marked at a moderate price. But what did this signify, when he had not a penny in his pocket? He turned away in despair, and wandered homeward, thinking how he could become possessed of the treasure. On reaching home, he found that his wife was abroad in the fields, for it was harvest time, and his eldest daughter was performing the duties of housekeeper in her mother's absence. He enquired of the child if her mother had paid the rent which he had given her a few days before, and on being answered in the negative he asked where she had put it. The daughter directed him to a teacup in the cupboard, where the father accordingly found it. He took the money and set off at once, as it was near the hour at which his wife was expected home, and he probably feared some remonstrance on taking it, if she were present. Meanwhile, Mrs. Hann returned, and the first news from the daughter was that her father had taken the money from the cupboard. The wife set out in pursuit, and accidentally came up with her husband before arriving at the shop. She remonstrated, as he had anticipated, but he quieted her by saying that if he could get that book he believed he should "make all their fortunes." She at last consented that he might have it, and we have heard the poor fellow declare that the happiest moment in his life was when he became the owner of that work. It is rather singular that the author of it and Hann should in after years have become the most intimate of friends—so friendly, indeed, that the latter was entrusted with Dr. Gregory to superintend the publication of some of his unfinished works, in addition to educating his own son in mathematics.

As we have already said, Hann was much employed about the coal mines in Durham and Northumberland, where we still find him remembered for his pointed wit and good humour. We heard the following *bon mot* told of him by one of his early friends:—One night, when sitting in the engine-house at Hetton Colliery, where he was for some time employed as brakesman, one of the men went in, and pointing to the new moon, said, "Yonder is one-half of the moon, Jamie, where is the other?" Hann, nothing taken aback, replied at once, "Go and look in the adjoining pond, thou goose." Often, too, in later years, when we have been wandering along the streets of the metropolis with him, his wit has made us hold our sides with laughter.

But to return. Many of the best years of Hann's life were passed as a brakesman, until at length he was persuaded to open a school, and accordingly we find that he taught for a short time at Friar's Goose, near Newcastle. He began to write in the *Lady's Diary*, which was at that time, and still is, the only outlet in the country for the mathematical ability of self-taught men, and which has done more to foster a mathematical spirit in non-university men than any other periodical in the language. We find on reference to this work that he gained a prize in conjunction with Mr. W. S. B. Woolhouse, for having solved the prize question in the *Diary* for the year 1835, and we have often heard Hann remark how much gratified he was to have shared the prize with such a distinguished mathematician.

Three years prior to this he published, in conjunction with Mr. Isaac Dodds, *Mechanics for Practical Men*, which met with a good sale. Possessing the friendship of Mr. Woolhouse, who is a native of Shields, and who, owing to his great mathematical genius, had obtained the appointment of first assistant in the *Nautical Almanac* office, that gentleman succeeded in obtaining for Hann a situation as calculator in the same office, where he remained for some time. At length both Hann and his patron retired, when the former became a candidate for the appointment of writing-master in Kings' College School, from which he rose to be mathematical master. Here he remained until within a year or two of his death, universally beloved by all his pupils, many of whom after they left him became highly distinguished at Cambridge. Notwithstanding the onerous duties he had to perform in the College, and the difficulties of a private kind with which he had to contend in his domestic life, he still found opportunities to write several useful treatises, among which may be mentioned those on the "Steam-engine," "Bridges," &c. Mr. Hann possessed a great mathematical genius, and was not only well read in all scientific subjects, but also in literature, and his argumentative powers could hardly have been surpassed.

This great man departed this life on the morning of Sunday, Aug. 17 last, and was interred in Norwood Cemetry, being followed to the grave by his early associates, Messrs. Woolhouse and Baker, as well as a few more of his intimate friends, and the various members of his own family. It is the intention of a few of his admirers to erect a monument to his memory over the spot where his ashes repose, in order to testify their esteem for one who, amid many difficulties and troubles, was seldom or never known to murmur at his lot in life.

THE MINER'S HYMN.

Great God! Thy mighty hand appears
With equal pow'r divine,
If gazing on Thy glitt'ring spheres,
Or in the dreary mine.

The sapphire, diamond, ruby bright,
To Thee their lustre owe;
The baser metals by Thy might
Their useful presence show.

Created for man's earthly need,
While in this vale of tears;
Let him at work this lesson read,
To calm his doubts and fears.

If God, so bounteous unto man,
Display His Heavenly love;
His glories, Oh! what mind can scan,
The angels sing above.

His Son hath said—O joyful sound—
"If ye but do His will,"
These glories shall by all be found
Upon great Zion's hill.

Then let us all with one accord,
His paths with joy pursue;
Direct our lives by His great word,
To see these glories too.

Iron Metallurgy.—Mr. S. B. Rogers, of Nant-y-Glo, Monmouthshire, has in the press, for publication in December, a Treatise on Iron Metallurgy, illustrated by steel plates, with suggestions for many essential improvements in the manufacture of iron, and a more perfect system of conducting extensive iron-works. A series of elaborate analytical tables connected with iron-making materials will be added to the work, the importance of which can hardly be over-estimated at this time, from the high scientific acquirements and great practical experience of the author. To be published at the *Mining Journal* office, price 35s.; to subscribers, whose names will be received at our office, 30s.

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There is a stream of water available within the limits of the sett, which can be applied for the purposes of stamping and crushing ores, and such other uses as may be required for the working of the mine.

The sett has been inspected by competent persons, who have pronounced it to be a valuable property, and considered it worthy of being fully developed.

This mine is to be conducted strictly on the Cost-book Principle; regular meetings will be held on the mine, or such other place, or places, as may appear more convenient to a majority of shareholders; and no liabilities will be incurred but such as are determined on at the meetings.

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Application for shares can be made to Mr. WM. WILLIAMS, mining agent, Buckfastleigh, sole promoter, who has incurred a considerable outlay in obtaining the sett, &c.; to Mr. HENRY STENTIFORD, Ashburton, who will, if required, show the property, or sett, to any parties disposed to examine it; to Mr. WM. WILLIAMS, Tavistock; or to the purser, from whom prospectuses, and all particulars as to the holding of the mine, &c., may be obtained.

Not less than 10 shares will be issued to any individual until the whole of the shares, as above, are allotted. Purser and Sec., *pro tem.*,

Totnes, Nov. 3, 1856. MR. A. HILL, Mining Office, Totnes, Devon.

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SIR,—I request you to allot me parts, or shares, in the Wrey Consols Mine, which number I hereby agree to accept, and to pay the deposit of 5s. per share, herewith enclosed; also the calls on same, in accordance with the prospectus. 152

I am, Sir, yours, &c.,.....

o Mr. A. Hill, Mining Office, Totnes, Devon.

DEVON WHEAL DUCHY.

This is in a piece of hitherto-neglected, but very promising, mining property, although formerly considered one of the richest in Devonshire for tin. The stratum is a beautiful clay-slate, forming a junction with the granite; it is the nearest mine to the granite hills of Dartmoor, in the parish of Whitchurch. It is situated to the east of Devon Burra Burra, Whitchurch Consols, and East and West Sortridge, all the lodes of which run through this sett. It has Huckworthy Bridge Mine and North Wheal Robert to the south; and the Great Wheal Friendship to the north, which has been yielding dividends for the last 50 years.

The ancient miners have done a great deal on the banks of the tin lodes.

There are two very promising lodes laid open, one a tin lode, sunk 4 fms., with good stones of tin, the other a very fine copper lode, 7 feet wide, composed of gossan, prian, and mundic, with good spots of copper, with every appearance to warrant a course of ore at no great depth, with several other tin and copper lodes not yet wrought upon.

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Any mining capitalist who would like to engage in such a promising piece of mining property, may obtain all necessary information by a letter directed to "R. T.," Moor's Shop, Whitchurch, Devon.

There is another important feature connected with this sett, and that is the immense and highly-metalliferous cross-course which passes through the Wheal Friendship and Devon Burra Burra Mines, which takes its bearing to the west of this sett. There has been but one mine tried by this cross-course, which is between the granite and killas, and that is Wheal Friendship, which has been very successful; and there is not the least doubt, if tried on east and west lodes, by this cross-course, they will make large deposits. 153

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London, Oct. 17, 1856. 154

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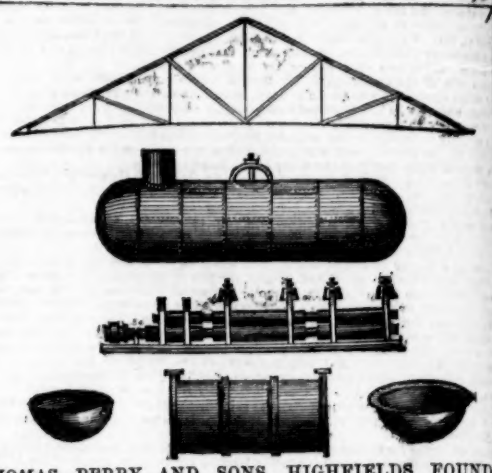

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